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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/812,355 | 03/30/2004 | Hongyu Yue | 071469-0307699 (ES-040) | 4102 |

69792 7590 06/26/2007

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| ART UNIT | PAPER NUMBER |
|---|---|
| 1765 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 06/26/2007 | PAPER |

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**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Application Number: 10/812,355
Filing Date: March 30, 2004
Appellant(s): YUE, HONGYU



E. Rico. Hernandez
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed March 7, 2007 appealing from the Office action mailed June 7, 2006.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

| | | |
|---|---|---|
| 20040185583 | TOMOYASU et al. | 9-2004 |
| 20040110354 | NATZLE et al. | 6-2004 |
| 20040099377 | NEWTON et al. | 5-2004 |
| 20040241981 | DORIS et al. | 12-2004 |

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-5 and 7-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomoyasu et al. (US 2004/0185583; hereinafter "Tomoyasu").

Appellant states that the instant application is assigned to Tokyo Electron Limited by an assignment filed June 24, 2004 is acknowledged. The fact that the reference and the application have the same assignee is **not**, by itself, sufficient evidence. The common ownership must be "at the time the invention was made." Since the assignment of June 24, 2004 is later than the application's filing date, it is not sufficient to overcome the rejection.

In a method for chemical oxide removal, Tomoyasu (abstract; ([0007], [0059], [0074], [0200]; Fig. 2) teaches that a chemical oxide removal process may be performed using a process recipe including a first reactant, a second reactant, and a process pressure in order to acquire trim amount data as a function of a variable parameter. Tomoyasu (abstract; ([0007], [0059], [0074], [0200]; Fig. 2) teaches that a process recipe including setting an amount of a first reactant, a second reactant such as $NH_3$, HF, $H_2$, $O_2$, CO, $CO_2$, Ar, He, see [0200]. Hence, it would have been obvious to one with ordinary skill in the art to use these gases and combinations thereof. Tomoyasu [0007, lines 4-5] teaches setting an amount of an inert gas in order to achieve the trim amount.

***"It is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose."***
***In re Kerkhoven 205 USPQ 1069 (CCPA 1980). In re Susi 169 USPQ 423, 426 (CCPA 1971); In re Crockett 126 USPQ 186, 188 (CCPA 1960). See also Ex parte Quadranti 25 USPQ 2d 1071 (BPAI 1992).***

Tomoyasu [0007, lines 4-5] teaches adjusting one or more chemical processing parameters, therefore, it reads on appellant's " maintaining at least one constant

parameter constant". Tomoyasu teaches the claimed variable parameters. Tomoyasu ([0007], [0074]) teaches that the etch rate model (which is a function of variable parameters) can be used along with a processing time to compute an etch depth (so-called target trim amount in the instant claims) which is considered to read on appellant's " using the target trim amount and the relationship to determine a target value for the variable parameter". Tomoyasu teaches changing process pressure and chemical treatment gas flow rates (e.g., gas flow rates of HF, $NH_3$, or inert gas), which are proportional to partial pressure (or a mole fraction) of each reactant according to the principle of basic physics, therefore, it is considered to read on instant claims 2 and 3. Tomoyasu also teaches thermally treating the substrate and rinsing the substrate following the chemical treating. Tomoyasu ([0007], [0074]) teaches adjusting the amount of inert gas (gas flow rate) in order to remove the desired amount of the chemical oxide. Tomoyasu teaches using charts, and various models for analysis. Tomoyasu clearly shows that process parameters and composition of chemical treatment gases are result-effective variables. The process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. In the absence of showing criticality or new, unexpected results, a person having ordinary skill in the art would have found it obvious to modify the prior art by performing routine experiments (by using different process parameters and compositions) to obtain optimal result with a reasonable expectation of success.

**Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical ( i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP 2144.05 II.**

As to dependent claim 10, see [0062].

As to dependent claims 11 and 12, see [0041] and [0074].

Claims 1-3 and 7-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Natzle et al. (US 2004/0097047; hereinafter "Natzle") in view of Tomoyasu et al. (US 2004/0185583) or Newton et al. (US 2004/0099377).

In a method for chemical oxide removal, Natzle ([0014], [0037],[0038], [0042]-[0044]) teaches that a chemical oxide removal process may be performed using a process recipe including a first reactant , a second reactant, and a process pressure.. Natzle [0042] teaches acquiring trim amount data as a function of variable parameters (such as temperature, composition, residence time pressure of the reactant, the amount of reactant or the rate of reactant), **all of which can be regulated,** which is considered to read on appellant's " maintaining at least one constant parameter constant". Natzle [0042] also discloses that the aforementioned variable parameters influence the amount removed. Therefore, it would have been obvious to one with ordinary skill in the art to use the target trim amount and the relationship to determine a target value for the variable parameter. The instantly claimed invention differs from Natzle by specifying well-known features (such as adding inert gas to the etchant) to the art of semiconductor device fabrication. In a method for chemical oxide removal, Tomoyasu teaches that a chemical oxide removal process may be performed using a process recipe including setting an amount of treatment gases such as $NH_3$, HF, $H_2$, $O_2$, CO, $CO_2$, Ar, He, see [0200]. In a method for chemical oxide removal, Newton

([0073],[0074]), teaches that a chemical oxide removal process may be performed using a process recipe including setting an amount of a first reactant, a second reactant, and inert gas (e.g., HF, $NH_3$, or inert gas). Newton teaches setting an amount of an inert gas in order to achieve the trim amount. Because it is a well-known feature in the art of semiconductor device fabrication and because it is disclosed by Tomoyasu or Newton, hence, it would have been obvious to one with ordinary skill in the art to incorporate inert gas in the process of Natzle, in order to efficiently remove the chemical oxide.

The aforementioned references clearly show that process parameters and composition of chemical treatment gases are result-effective variables. The process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. In the absence of showing criticality or new, unexpected results, a person having ordinary skill in the art would have found it obvious to modify the prior art by performing routine experiments (by using different process parameters and compositions) to obtain optimal result with a reasonable expectation of success.

**Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical ( i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP 2144.05 II.**

Natzle teaches changing pressure of reactant and flow rates, which are proportional to partial pressure (or a mole fraction) of each reactant according to the basic physics principles, therefore, the combined prior art is considered to read on instant claims 2 and 3.

As to dependent claim 10, see [0014] of Natzle.

As to dependent claims 11 and 12, after gathering information of etching rates, thickness, process parameters), it would have been obvious to one with ordinary skill in the art to tabulate / extrapolate / manipulate data and perform calculation using common statistical methods (such as regression, extrapolation, best-fit, polynomial, least squares, interpolation) and numerical analysis. It is noted that appellant did not traverse the aforementioned conventionality (e.g., common knowledge), which have been stated in the previous office action (January 12, 2006).

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Natzle in view of Tomoyasu or Newton as applied to claim 1 above, and further in view of Doris et al. (US 2004/0241981; hereinafter "Doris").

The discussion of modified Natzle (in view of Tomoyasu or Newton) from above is repeated here.

The modified Natzle (in view of Tomoyasu or Newton) is silent about the heating and rinsing with water after the chemical treating. In a method for chemical oxide removing, Doris teaches heating and rinsing with water after the chemical treating so as to efficiently remove the solid reaction product, see [0046]. Hence, it would have been obvious to one with ordinary skill in the art to modify Natzle (in view of Tomoyasu or Newton) by heating and rinsing with water as taught by Doris in order to efficiently remove the solid reaction product.

**(10) Response to Argument**

Appellant has argued that Tomoyasu does not teach or suggest performing a chemical oxide removal process using a process recipe including a first reactant, a

second reactant, an inert gas and a process pressure in order to acquire trim amount data as a function of a variable parameter, while maintaining at least one constant parameter constant; determining a relationship between the trim amount data and said variable parameter; using the target trim amount and the relationship to determine a target value for the variable parameter. It is not persuasive. As has been stated in the office action, Tomoyasu (abstract; ([0007], [0059], [0074], [0200]; Fig. 2) teaches that a chemical oxide removal process may be performed using a process recipe including a first reactant, a second reactant, and a process pressure in order to acquire trim amount data as a function of a variable parameter. Tomoyasu (abstract; ([0007], [0059], [0074], [0200]; Fig. 2) teaches that a process recipe including setting an amount of a first reactant, a second reactant such as $NH_3$, HF, $H_2$, $O_2$, CO, $CO_2$, Ar, He, see [0200]. Hence, it would have been obvious to one with ordinary skill in the art to use these gases and combinations thereof. Tomoyasu [0007, lines 4-5] teaches setting an amount of an inert gas in order to achieve the trim amount. Tomoyasu [0007, lines 4-5] teaches adjusting one or more chemical processing parameters, therefore, it reads on appellant's " maintaining at least one constant parameter constant". Tomoyasu ([0007], [0074]) teaches that the etch rate model (which is a function of variable parameters) can be used along with a processing time to compute an etch depth (so-called target trim amount in the instant claims) which is considered to read on appellant's " using the target trim amount and the relationship to determine a target value for the variable parameter".

Appellant has argued that Tomoyasu does not teach or suggest determining a relationship between trim amount data and a partial pressure of a gas specie and an inert gas for said process recipe; setting the target trim amount, and using the relationship and said target trim amount to determine a target value of the partial pressure of the gas specie and the inert gas. It is not persuasive. As stated in the office action, Tomoyasu teaches changing process pressure and chemical treatment gas flow rates (e.g., gas flow rates of HF, $NH_3$, or inert gas), which are proportional to partial pressure (or a mole fraction) of each reactant according to the principle of basic physics. Tomoyasu ([0007], [0074]) teaches adjusting the amount of inert gas (gas flow rate) in order to remove the desired amount of the chemical oxide. Therefore, same reasons as aforementioned in last paragraph are also applied.

Appellant has argued that Natzle in view of Tomoyasu or Newton do not teach or suggest any correlation between specific factors nor does prior art teach using a process recipe including a first reactant, a second reactant, an inert gas and a process pressure in order to acquire trim amount data as a function of a variable parameter, while maintaining at least one constant parameter constant; determining a relationship between the trim amount data and said variable parameter. It is not persuasive. As has been stated in the office action, Natzle ([0014], [0037],[0038], [0042]-[0044]) teaches that a chemical oxide removal process may be performed using a process recipe including a first reactant , a second reactant, and a process pressure.. Natzle [0042] teaches acquiring trim amount data as a function of variable parameters (such as temperature, composition, residence time pressure of the reactant, the amount of

reactant or the rate of reactant), **all of which can be regulated.** Natzle [0042] also discloses that the aforementioned variable parameters influence the amount removed. Therefore, it would have been obvious to one with ordinary skill in the art to use the target trim amount and the relationship to determine a target value for the variable parameter. The instantly claimed invention differs from Natzle by specifying well-known features (such as adding inert gas to the etchant) to the art of semiconductor device fabrication. Tomoyasu teaches that a chemical oxide removal process may be performed using a process recipe including setting an amount of treatment gases such as $NH_3$, HF, $H_2$, $O_2$, CO, $CO_2$, Ar, He, see [0200]. Newton ([0073],[0074]) teaches setting an amount of an inert gas in order to achieve the trim amount. Because it is a well-known feature in the art of semiconductor device fabrication and because it is disclosed by Tomoyasu or Newton, hence, it would have been obvious to one with ordinary skill in the art to incorporate inert gas in the process of Natzle, in order to efficiently remove the chemical oxide.

Appellant has argued that Natzle in view of Tomoyasu or Newton do not teach or suggest determining a relationship between trim amount data and a partial pressure of a gas specie and an inert gas for said process recipe; setting the target trim amount, and using the relationship and said target trim amount to determine a target value of the partial pressure of the gas specie and the inert gas. It is not persuasive. As stated in the office action, Natzle teaches changing pressure of reactant and flow rates, which are proportional to partial pressure (or a mole fraction) of each reactant according to the

principle of basic physics. Therefore, same reasons as aforementioned in last paragraph are also applied.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

K. C.

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Primary Examiner
Art Unit 1765

May 31, 2007

Conferees:

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